

Appendix A

Composting Emissions Summary

Composting operations at 28 dtpd			
Compound	Average Rate (lbs)		
	Hourly	Daily	Annual
Ammonia ¹			9.11E+02
Dimethyl disulfide ¹			2.10E+02
Hydrogen sulfide ²	7.50E-04	1.80E-02	6.57E+00
Carbonyl sulfide ²	1.75E-03	4.20E-02	1.53E+01
Carbon disulfide ²	2.00E-03	4.80E-02	1.75E+01
Methyl mercaptan ²	2.00E-03	4.80E-02	1.75E+01
Dimethyl sulfide ²	7.50E-03	1.80E-01	6.57E+01
Methane ²	1.37E+00	3.29E+01	1.20E+04
Trimethylamine	Not Available		
MEK ²	4.70E-02	1.13E+00	4.12E+02
Xylene ²	2.25E-03	5.40E-02	1.97E+01
Styrene ²	5.00E-04	1.20E-02	4.38E+00
2-Methylthiophene ²	5.00E-04	1.20E-02	4.38E+00
2-Heptanone ²	2.00E-03	4.80E-02	1.75E+01
3-Heptanone ²	5.00E-04	1.20E-02	4.38E+00
Pyridine ²	2.25E-02	5.40E-01	1.97E+02
Total other VOCs ²	0.383		
Total VOCs ²	1.10E+00	2.64E+01	9.64E+03
HAPs ²	6.82E-01	1.64E+01	5.97E+03

Notes:

1. From measurements taken at the facility from 10/99 through 7/2001
2. Estimates based on DEC data from 7/21/97 with assumed 75% control from scrubber.

Appendix B
Alkaline Stabilization Emissions
Summary

Alkalyne Stabilization at 40 wtpd Average and 99 wtpd Peak										
Compound	Average Emission Rate	Units	Multiplier	Units	Average Rate (lbs)			Maximum Rate (lbs)		
					Hourly	Daily	Annual	Hourly	Daily	Annual
Ammonia ¹	0.62	lbs/hour	NA		6.20E-01	1.49E+01	5.43E+03	1.53E+00	3.68E+01	1.34E+04
Dimethyl disulfide ²	2.18E-07	lbs/min ft ² surface	18,900	ft2	2.47E-01	5.93E+00	2.17E+03	6.12E-01	1.47E+01	5.36E+03
	4.74E-16	lbs/lbs biosolids processed	167	lbs/min	4.74E-12	1.14E-10	4.15E-08	1.17E-11	2.82E-10	1.03E-07
				Totals	2.47E-01	5.93E+00	2.17E+03	6.12E-01	1.47E+01	5.36E+03
Hydrogen sulfide ²	2.95E-11	lbs/min ft ² surface	18,900	ft2	3.35E-05	8.03E-04	2.93E-01	8.28E-05	1.99E-03	7.25E-01
	2.65E-16	lbs/lbs biosolids processed	167	lbs/min	2.65E-12	6.36E-11	2.32E-08	6.56E-12	1.57E-10	5.75E-08
				Totals	3.35E-05	8.03E-04	2.93E-01	8.28E-05	1.99E-03	7.25E-01
Carbonyl sulfide ²	7.33E-11	lbs/min ft ² surface	18,900	ft2	8.31E-05	1.99E-03	7.28E-01	2.06E-04	4.94E-03	1.80E+00
	4.64E-16	lbs/lbs biosolids processed	167	lbs/min	4.64E-12	1.11E-10	4.06E-08	1.15E-11	2.76E-10	1.01E-07
				Totals	8.31E-05	1.99E-03	7.28E-01	2.06E-04	4.94E-03	1.80E+00
Carbon disulfide ²	7.83E-10	lbs/min ft ² surface	18,900	ft2	8.88E-04	2.13E-02	7.78E+00	2.20E-03	5.27E-02	1.93E+01
	2.94E-16	lbs/lbs biosolids processed	167	lbs/min	2.94E-12	7.06E-11	2.58E-08	7.28E-12	1.75E-10	6.37E-08
				Totals	8.88E-04	2.13E-02	7.78E+00	2.20E-03	5.27E-02	1.93E+01
Methyl mercaptan ²	8.12E-09	lbs/min ft ² surface	18,900	ft2	9.21E-03	2.21E-01	8.07E+01	2.28E-02	5.47E-01	2.00E+02
	3.74E-16	lbs/lbs biosolids processed	167	lbs/min	3.74E-12	8.98E-11	3.28E-08	9.26E-12	2.22E-10	8.11E-08
				Totals	9.21E-03	2.21E-01	8.07E+01	2.28E-02	5.47E-01	2.00E+02
Dimethyl sulfide ²	2.18E-07	lbs/min ft ² surface	18,900	ft2	2.47E-01	5.93E+00	2.17E+03	6.12E-01	1.47E+01	5.36E+03
	4.74E-16	lbs/lbs biosolids processed	167	lbs/min	4.74E-12	1.14E-10	4.15E-08	1.17E-11	2.82E-10	1.03E-07
				Totals	2.47E-01	5.93E+00	2.17E+03	6.12E-01	1.47E+01	5.36E+03
Methane ²		lbs/min ft ² surface	18,900	ft2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		lbs/lbs biosolids processed	167	lbs/min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
				Totals	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Trimethylamine ²	2.76E-08	lbs/min ft ² surface	18,900	ft2	3.13E-02	7.51E-01	2.74E+02	7.75E-02	1.86E+00	6.79E+02
	8.86E-12	lbs/lbs biosolids processed	167	lbs/min	8.86E-08	2.13E-06	7.76E-04	2.19E-07	5.26E-06	1.92E-03
				Totals	3.13E-02	7.51E-01	2.74E+02	7.75E-02	1.86E+00	6.79E+02
MEK	Not Available									
Xylene	Not Available									
Styrene	Not Available									
2-Methylthiophene	Not Available									
2-Heptanone	Not Available									
3-Heptanone	Not Available									
Pyridine	Not Available									
Total other VOCs	Not Available									
Total VOCs ³	0.14	lbs/hour	NA		1.37E-01	3.28E+00	1.20E+03	3.38E-01	8.11E+00	2.96E+03
HAPs ³	0.0855	lbs/hour	NA		8.55E-02	2.05E+00	7.49E+02	2.12E-01	5.08E+00	1.85E+03

Notes:

1. From 2003 sampling scaled for new production rate of 40 tph average and 99 tph maximum
2. Estimates use highest emission rates for handling processing and stockpiles from previous permit application
3. Same emission rates from previous application

Appendix C
Non-Biosolids VOC Emissions
Summary

SUMMARY OF EMISSIONS FROM THE CLINTON COUNTY COMPOSTING FACILITY - NON-BIOSOLIDS SOURCES AND VOC SUMMARY

Non-Biosolids Activities

Item	SO ₂	NO _x	CO	PM ^b	PM-10	VOC
	tpy	tpy	tpy	tpy	tpy	tpy
Boiler ^a	28.4	4.24	1.06	0.43	0.21	0.07
Backup Generator ^a	0.04	0.65	0.14	0.2	0.05	0.05
Kerosine heaters ^a (8)	2.95	2.08	0.52	0.21	0.1	0.04
Tank 1 ^a (1000 gal)						1.95
Tank 2 ^a (4,000 gal)						1.28
Tanks 3-10 ^a (500 gal each)						9.12
Dry Feeders ^c				0.0227	0.0078	
Total	31.39	6.32	1.72	0.863	0.368	12.51

^aSee attached spreadsheets for assumptions and calculation details. All follow AP-41.

^bPM for Backup Generator estimated by applying PM:PM-10 ratio for Boiler

^cFollowing Table 11.12-2, Cement unloading to elevated storage silo (pneumatic) in AP-42

Lime + LKD feeder = 27,388 tpy

Fly Ash feeder = 18,500 tpy

Total = 27388 + 18500 = 45,900 tpy fed

Emissions factors (controlled): 0.00099 lb PM/ton loaded
0.00034 lb PM-10/ton loaded

Therefore:

45,900 tpy x 0.00099 = 45 lb PM/yr (0.022 tpy)

45,900 x 0.00034 = 15.6 lb PM-10/yr (0.0078 tpy)

Total PTE of VOCs = 12.51 (above) + 5.50 tpy (from biosolids processing = 18.0 tpy VOC

Appendix D

Combustion Sources Emissions Calculations

Table 1
Backup Diesel Generator
Criteria Pollutant Calculations

ASSUMPTIONS

Number of
Generators:
Heat Value:
rating

1
1.40E-01
935

MMBTU/ gal
hp - output

Hours per generator per year:
Maximum Hours per year - all generators combined:

125	hrs
125	generator-hrs

RESULTS

Emission Factor for Maximum Load		Nitrogen Oxides NOx	Carbon Monoxide CO	Particulate Matter Less than 10 um PM-10	Sulfur Dioxide SOx	Total Organic Carbons TOC
Units for Emission Factor	lb/bhp-hour or lb/MMBtu	3.10E-02	6.68E-03	2.20E-03	2.05E-03	2.51E-03
Source for Emission Factor	lb/bhp-hour	lb/bhp-hour	lb/bhp-hour	lb/bhp-hour	lb/bhp-hour	lb/bhp-hour
Estimated Emissions for Maximum Load	ton/year	0.6491	0.1399	0.05	0.04	0.05

EQUATIONS

Estimated Emissions for AP-42 lb/bhp-hour Emission Factors (tons) =
Emission factor (lb/bhp-hr) x Hours of Operation (all generators) x 1 ton / 2000 lb x power output rating (hp)

REFERENCES

AP-42 Emission Factors obtained from AP-42, Chapter 3.3 "Gasoline and Diesel Industrial Engines", Table 3.3-1,
October 1996.

Boilers- Potential To Emit/Actual No. 2 Fuel Oil Combustion Emissions

Emissions Unit	Heat Input rating (MMBtu/hr)	No. 2 Fuel Oil Usage (1,000 gallons)	Emission Factors (lb/ 1000 gallons)								Actual Emissions (ton/yr)					
			SO ₂	NOx	CO	PM	PM-10	Lead	VOC	SO ₂	NOx	CO	PM	PM-10	Lead	VOC
Boiler	6.8	425.49	28.40	20.0	5.0	2	1	1.26E-03	0.3	6.04	4.25	1.06	0.43	0.21	0.0003	0.07

1) Equations used:

- a) Actual emissions (ton/yr) = $[\text{No. 2 fuel oil usage (1,000 gallons burned)}] \times [\text{emissions factor (lb/ 1000 gallons)}] \times [1 \text{ ton}/2,000 \text{ lb}]$
- c) Lead Emission Factor (lb/ 1000 gallons) = $[\text{Emission Factor (lb}/10^{12} \text{ Btu)}] \times [\text{Wt. Avg. Fuel Oil Heat Content (Btu/gal)}] \times [1000 \text{ gal}/1 [1000 \text{ gal}]] \times [1 \text{ } 10^{12} \text{ Btu}/1,000,000,000,000 \text{ Btu}]$
- c) Boiler Maximum Fuel throughput (1,000 gallons/yr) = $[\text{Boiler Heat Capacity (MMBtu/hr)}] \times [1,000,000 \text{ Btu/MMBtu}] \times [1/(\text{Wt. Avg. Fuel Oil Heat Content (Btu/gal)})] \times [1 [1000 \text{ gal}]/1000 \text{ gal}]$

2) Assumptions:

- a) No startup, shutdown or malfunctions.
- b) The weighted average heat content of distillate No. 2 fuel oil is: $9 \text{ } 10^{12} \text{ Btu per AP-42 reference 3) a).}$
- c) Lead emission factor is $48,000 \text{ Btu/gal per Reference 3) c).}$
- d) Maximum SO₂ Emission Factor is: $1425 \text{ S} = 0.2 \Rightarrow 28.40 \text{ lb}/1,000 \text{ gallon}$
- e) Sulfur content (S) based on value reported by fuel supplier
- f) VOC emission factor represents non-methane TOC from Reference 3) a).
- g) No. 2 Fuel Oil Usage based on maximum heat input rating for a PTE calculation
- h) Boiler Heat Capacity (MMBtu/hr) per Reference 3) b).

3) References:

- a) AP-42, 5th Edition, Section 1.3 ("Fuel Oil Combustion"), Tables 1.3-3 and 1.3-6, September, 1998.
- b) Boiler heat input rating provided by plant personnel.
- a) AP-42, 5th Edition, Appendix A.

Heaters- Potential To Emit/Actual Kerosene (No. 1 Fuel Oil) Combustion Emissions

Emissions Unit	Heat Input rating (MMBtu/hr)	Kerosene / No. 1 Fuel Oil Usage (1,000 gallons)	Emission Factors (lb/ 1000 gallons)							Actual Emissions (ton/yr)						
			SO ₂	NOx	CO	PM	PM-10	Lead	VOC	SO ₂	NOx	CO	PM	PM-10	Lead	VOC
8 Kerosene heaters	4.8	208.00	28.40	20.0	5.0	2	1	1.22E-03	0.3	2.95	2.08	0.52	0.21	0.10	0.0001	0.04

1) Equations used:

- Actual emissions (ton/yr) =
Kerosene usage (1,000 gallons burned) x [emissions factor (lb/ 1000 gallons)] x [1 ton/2,000 lb]
- Lead Emission Factor (lb/ 1000 gallons) =
[Emission Factor (lb/10¹² Btu)] x [Wt. Avg. Fuel Oil Heat Content (Btu/gal)] x [1000 gal/1 [1000 gal]] x [1 10¹² Btu/1,000,000,000 Btu]
- Boiler Maximum Fuel throughput (1,000 gallons/yr) =
Capacity of Tank (500 gallons) x number of Tanks (8) x Fill Rate (2 times per week) x 26 weeks per year x [1 1000 gal/ 1000 gal]

2) Assumptions:

- No startup, shutdown or malfunctions.
- The weighted average heat content of kerosene / fuel oil No. 1 is:
9 lb/10¹² Btu per AP-42 reference in 3) a).
- Lead emission factor is
142S S= 0.2 => 28.40 lb/1,000 gallon
- Maximum SO₂ Emission Factor is:
142S S= 0.2 => 28.40 lb/1,000 gallon
- Sulfur content (S) based on reported value
- VOC emission factor represents non-methane TOC from Reference 3) a).
- Kerosene / No. 1 Fuel Oil Usage based on maximum heat input rating for a PTE calculation
- Boiler Heat Capacity (MMBtu/hr) per Reference 3) b).
- Since kerosene is a distillate oil, as is diesel fuel, emission factors for kerosene were assumed to be same as either distillate or diesel commercial boilers.
- Number of Kerosene Tanks = number of Kerosene heaters = 8 (eight) .6 MMBtu/hr units

3) References:

- AP-42, 5th Edition, Section 1.3 ("Fuel Oil Combustion"), Tables 1.3-3 and 1.3-6, September, 1998.
- Boiler heat input rating provided by plant personnel.
- AP-42, 5th Edition, Appendix A.

Appendix E

Tanks Emission Summary

TANKS 4.0

Emissions Report - Summary Format

Tank Identification and Physical Characteristics

Identification
User Identification: 1
City: Albany
State: New York
Company: County Composting (TTISG)
Type of Tank: Horizontal Tank
Description: Boiler No. 2 fuel oil tank

Tank Dimensions
Shell Length (ft): 10.75
Diameter (ft): 4.00
Volume (gallons): 1,000.00
Turnovers: 425.50
Net Throughput (gall/yr): 425,500.00
Is Tank Heated (y/n): N
Is Tank Underground (y/n): N

Paint Characteristics
Shell Color/Shade: Aluminum/Diffuse
Shell Condition: Good

Breather Vent Settings
Vacuum Settings (psig): -0.03
Pressure Settings (psig): 0.03

Meteorological Data used in Emissions Calculations: Albany, New York (Avg Atmospheric Pressure = 14.59 psia)

TANKS 4.0

Emissions Report - Summary Format

Liquid Contents of Storage Tank

Mixture Component	Mons	Daily Liquid Sur- face Temperature (deg F)		Liquid Bulk Temp (deg F)	Vapor Pressures (psia)		Vapor Mol Wt	Liquid Mass Fract	Vapor Mass Fract	Mol Basis for Vapor Pressure Weight Calculators	
		Avg	Max		Avg	Max				Weight	Calculation
Disillate fuel oil no 2	All	54.50	60.41	49.95	0.0054	0.0073	130.0000			188.00	Option 5, A=12 101 0=9937

TANKS 4.0 Emissions Report - Summary Format Individual Tank Emission Totals

Annual Emissions Report

Components	Working Loss	Losses(lbs)	Total Emissions
Distillate fuel oil no. 2	1.69	Breathing Loss 0.26	1.95

TANKS 4.0

Emissions Report - Summary Format

Tank Identification and Physical Characteristics

Identification
User Identification: 2
City: Albany
State: New York
Company: Composting Facility (TTISG)
Type of Tank: Horizontal Tank
Description: Generator No. 2 fuel oil tank

Tank Dimensions
Shell Length (ft): 17.00
Diameter (ft): 6.50
Volume (gallons): 4,000.00
Turnovers: 25.00
Net Throughput (gal/yr): 100,000.00
Is Tank Heated (y/n): N
Is Tank Underground (y/n): Y

Paint Characteristics
Shell Color/Shade: Red/Primer
Shell Condition: Good

Breather Vent Settings
Vacuum Settings (psig): -0.03
Pressure Settings (psig): 0.03

Meteorological Data used in Emissions Calculations: Albany, New York (Avg Atmospheric Pressure = 14.59 psia)

TANKS 4.0 Emissions Report - Summary Format Liquid Contents of Storage Tank

Mixture Component	Month	2015 Liquid Surface Temperatures (deg F)		Liquid Bulk Temp. (deg F)		Vapor Pressures (psia)		Vapor Mass Weight	Liquid Mass Fract.	Vapor Mass Fract.	Mol Weight	Basis for Vapor Pressure Calculations
		Avg.	Min.	Max.		Avg.	Min.	Max.				
Distillate fuel oil no. 2	All	48.79	48.79	48.79	48.33	0.0341	0.0341	0.0341	130.0203		186.30	Option 5 A=12 101 B=18927

TANKS 4.0
Emissions Report - Summary Format
Individual Tank Emission Totals

Annual Emissions Report

Components	Working Loss	Losses(lbs) Breathing Loss	Total Emissions
Distillate fuel oil no. 2	1.28	0.00	1.28

TANKS 4.0

Emissions Report - Summary Format

Tank Identification and Physical Characteristics

Identification
 User Identification: 3 (Kerosene)
 City: Albany
 State: New York
 Company: Compositing Facility (TTISG)
 Type of Tank: Vertical Fixed Roof Tank
 Description: Kerosene heater fuel tank

Tank Dimensions
 Shell Height (ft): 7.00
 Diameter (ft): 5.00
 Liquid Height (ft): 3.80
 Avg. Liquid Height (ft): 2.00
 Volume (gallons): 558.14
 Turnovers: 52.00
 Net Throughput (gal/yr): 29,023.52
 Is Tank Heated (y/n): N

Paint Characteristics
 Shell Color/Shade: Red/Primer
 Shell Condition: Poor
 Roof Color/Shade: Red/Primer
 Roof Condition: Poor

Roof Characteristics
 Type: Dome
 Height (ft): 1.00
 Radius (ft) (Dome Roof): 5.00

Breather Vent Settings
 Vacuum Settings (psig): -0.03
 Pressure Settings (psig): 0.03

Meteorological Data used in Emissions Calculations: Albany, New York (Avg Atmospheric Pressure = 14.59 psia)

TANKS 4.0

Emissions Report - Summary Format

Liquid Contents of Storage Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F)	Liquid Bulk Temp. (deg F)	Vapor Pressure (psia)	Vapor Mol. Weight	Liquid Mass Fraction	Vapor Mass Fraction	Mol. Weight Basis for Vapor Pressure Calculations
Jet kerosene	All	Avg 58.49 Min 46.94 Max 70.00	51.61	Avg 0.0075 Min 0.0053 Max 0.0114	130.0000			162.00 Option 5: A=12.33 B=0.803

TANKS 4.0
Emissions Report - Summary Format
Individual Tank Emission Totals

Annual Emissions Report

Components	Losses (lbs)		Total Emissions
	Working Loss	Breathing Loss	
Jet kerosene	0.52	0.62	1.14

Appendix F
December 2003 Air Sampling Report

CLINTON COUNTY N-VIRO

AIR SAMPLING REPORT

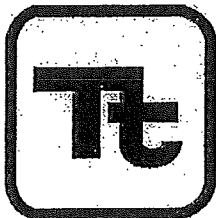
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Appendix A – Figures 2-1, 2-2, 2-3, & 2-4

Appendix B – Sampling Protocol

Appendix C – Lab Results



1.0 EXECUTIVE SUMMARY

Air sampling was undertaken at the Clinton County Biosolids Processing Facility for two (2) weeks for two (2) days each week. Sampling occurred on the following dates:

Week 1

Monday, October 6, 2003

Tuesday, October 7, 2003

Week 2

Monday, October 13, 2003

Tuesday, October 14, 2003

At the time of sampling, only the N-Viro alkaline stabilization process was operating. All sampling occurred while biosolids were being mixed and stockpiled through the N-Viro process.

The purpose of sampling was to test compliance with Conditions 22 and 25 of the facility Air Permit and to explore the possibility of eliminating Item 20.2 of Condition 20 and also examine the effect of turning off the stack emission fan.

Condition 22 limits the odor emissions from the facility to 100 D/T. Condition 25 limits the facility average ammonia emission to 9.0 pounds per hour. Condition 20 limits the processing of digested biosolids to 25% of the material processed by the facility.

Testing took place on four (4) separate days so that each condition to be tested could be isolated. Testing on October 6th involved sampling at the stack with the stack fan on while processing +/- 75% digested biosolids. Testing on October 7th was under the same conditions as October 6th with only +/- 25% digested biosolids processed through the facility. Testing on October 13th and 14th was under the same processing conditions as October 6th and 7th with the stack fan turned off and emission measured at both the stack and the doors.

A sampling protocol was submitted to and approved by the New York Department of Environmental Conservation (NY DEC) before testing was undertaken. Ammonia samples were taken using sorbent tubes and analyzed using NIOSH Method 6016. Odor samples were collected in Tedlar bags using a lung pump. The samples were analyzed by an odor panel using the forced choice olfactometer method (ASTM E-679-91). A copy of the approved protocol is in Appendix B. Airflow measurements were also taken from all sampling locations during testing. With the stack fan operating, the airflow from the facility averaged 507,833 cfm. With the stack fan off, the airflow from the stack averaged 70,264 cfm. Airflow from the doorways with the stack fan off varied widely in rate and direction. The doorway airflows were most affected by wind conditions around the facility.

The odor emissions from the stack with the fan operating ranged from 97 to 354 D/T with most of the reading in excess of the 100 D/T permit limit. With the stack fan off, odor

concentrations at the doors ranged from 35 to 1,107 D/T and at the stack from 177 to 3,562. Odors were lower in all but one case when the Evane Scent mist system was operating, but not enough to meet the 100 D/T permit limit. In addition, odors were lower when processing mostly digested biosolids as opposed to processing mostly undigested material.

The average facility ammonia emissions when processing mostly digested biosolids was 5.4 pounds per hour. When processing mostly undigested biosolids the average ammonia emission was 2.5 pounds per hour. The ammonia emission under both conditions is well below the permit allowable.

When processing a high percentage of digested biosolids, the odor emissions were reduced and the ammonia emissions were still well below the permit allowable. For these reasons, the Condition 20 limit of allowing only 25% of the biosolids processed to be digested appears to be unnecessary.

2.0 METHODS

Air sampling was undertaken at the Clinton County Biosolids Processing Facility for two (2) weeks for two (2) days each week. Sampling occurred on the following dates:

Week 1

Monday October 6, 2003

Tuesday October 7, 2003

Week 2

Monday October 13, 2003

Tuesday October 14, 2003

At the time of sampling, only the N-Viro alkaline stabilization process was operating. All sampling occurred while biosolids were being mixed and stockpiled through the N-Viro process.

Sampling occurred under four (4) different operating conditions with each sampling day devoted to a single condition. The sampling date and condition of operations are outlined below:

1. *Date:* Monday, October 6, 2003
Condition: Processing +/- 75% digested biosolids with the stack fan operating and all emission going through the stack.
2. *Date:* Tuesday, October 7, 2003
Condition: Processing +/- 25% digested biosolids with the stack fan operating and all emission going through the stack.
3. *Date:* Monday, October 13, 2003

Condition: Processing +/- 75 % digested biosolids with the stack fan turned off and emission going both through the doorways and some through the stack.

4. *Date:* Tuesday October 14, 2003

Condition: Processing +/- 25 % digested biosolids with the stack fan turned off and emission going both through the doorways and some through the stack.

Air samples collected from the stack on October 6th and 7th were analyzed for ammonia and odor concentration. On October 13th and 14th, samples were collected at two (2) doorways, and at the stack, and analyzed for odor concentration. Air temperature, relative humidity, and velocity were taken at all sampling locations.

The following equipment was used to collect the samples:

- 12 liter Tedlar bags
- Lung pump
- Tygon tubing
- SKC Model 224-PCXR4 sampling pump
- Gillian GilAir 5 sampling pump
- TSI Velocicalc Plus Model 8386 Multi-parameter ventilation meter
- SKC Silica Gel sorbent tubes
- Matheson Kitagawa Model 8014-4004 hand sampling pump
- Matheson Kitagawa Ammonia gas detector tubes 0.2 to 20 ppm range
- 1" x 1/2" wood strapping
- Nylon rope

The Tedlar bags were used to collect and hold the air samples sent for odor concentration analysis. The Tygon tubing connected the sampling apparatus to the air stream being sampled. The SKC and Gillian sampling pumps pulled the air sample through the silica gel tubes or the lung pump for sample collection. The TSI Velocicalc measured air velocity, temperature and relative humidity. The silica gel tubes collected the ammonia sample. The Matheson Kitagawa pump and ammonia detector tubes were used to determine preliminary ammonia concentrations that, in turn, were used to determine sampling times for the ammonia sample collection. The wood strapping and rope were used to suspend sampling tubing across the open doorways to collect the samples.

Figure 2-1 in Appendix A shows the apparatus used to collect odor samples from the stack. Figure 2-2 in Appendix A shows the apparatus used to collect the ammonia samples from the stack. Figure 2-3 in Appendix A shows the apparatus used to collect odor samples from the doorways.

A protocol outlining the proposed sampling was submitted to the New York Department of Environmental Conservation (NY DEC) for review and approval on July 9, 2003. After review and comment by the DEC, a revised protocol was sent to the DEC on July 25, 2003.



The protocol was approved by the NY DEC on August 4, 2003. Copies of the protocol and acceptance are located in Appendix B.

The protocol was followed during the sampling with the following exceptions:

- The protocol called for eight (8) ammonia samples from the stack, four (4) each of the two (2) days of Week 1 of sampling. The actual amount of samples taken was five (5); three (3) the first day and two (2) the second day. Low ammonia concentrations caused long sampling times (ranging from 1.58 to 4.42 hours per sample). These long times were required to stay within the range of the test method. In addition, sampling was limited only to hours when material was being blended.
- During Week 1 of sampling, 15 odor samples were collected from the stack. The protocol called for 16 samples. Seven (7) samples rather than eight (8) samples were collected on the first day because the facility was nearing the end of the available material to process.
- Only two (2) doors were open during Week 2 sampling. The protocol called for eight (8) samples each day [four (4) from each door]. A total of 10 samples were taken at the doors each day with an additional two (2) samples taken from the stack each day. Time allowed for the additional door samples. In addition, drafting was noted up the stack with the fan off and thus, odor samples were taken from the stack each day.

As noted in the protocol, Gas detector tubes were used to determine a preliminary ammonia concentration so that the sample rate and time could be adjusted to obtain a sufficient amount of ammonia to be measured by the test method. Detector tube readings ranged from less than 1 ppm to 2 ppm. These low reading resulted in long sampling times as noted above. These long sample times limited the number of ammonia samples that could be taken.

Figure 2-4 in Appendix A is a floor plan of the N-Viro processing area and shows the door sampling locations.

3.0 RESULTS

3.1 AIR MOVEMENT

During the first week of testing, the fan in the stack was operating and all samples were collected from the stack approximately 65 feet from the ground. The stack overall height is 110 feet and thus samples were collected from a 3 inch diameter sampling port cut in the side wall of the stack. Air velocity, temperature, and relative humidity were measured at various times during the day. The limited short cord and three (3) foot wand length of the TSI Velocalc limited the velocity, temperature and relative humidity to the outer one (1), two (2) and three (3) feet of the seven (7) foot radius stack. Table 3-1 summarizes these measurements:

Table 3-1 Stack Airflow Data With Stack Fan Operating

<i>Date Time</i>	<i>Air Velocity (ft/min)</i>	<i>Calculated Airflow (cfm)</i>	<i>Temperature (°F)</i>	<i>Relative Humidity (%)</i>
10/6/03 10:45 AM	1 ft in 3,300 2 ft in 3,340 3 ft in 3,340 average = 3,327	512,152	54.4	48.3
10/6/03 11:10 AM	1 ft in 3,255 2 ft in 3,340 3 ft in 3,340 average = 3,312	509,791	54.8	40.8
10/6/03 12:55 PM	1 ft in 3,250 2 ft in 3,350 3 ft in 3,350 average = 3,317	510,561	55.9	42.7
10/6/03 3:50 PM	1 ft in 3,300 2 ft in 3,450 3 ft in 3,350 average = 3,367	518,258	55.7	60.0
10/7/03 8:35 AM	1 ft in 3,000 2 ft in 3,325 3 ft in 3,180 average = 3,168	487,727	43.9	76.0
10/7/03 11:20 AM	1 ft in 3,400 2 ft in 3,110 3 ft in 3,400 average = 3,303	508,509	56.0	57.4

When operating, only two (2) doors are used to allow biosolids trucks into and out of the operating area (see Figure 2-4 in Appendix A), the remaining doors are closed. During testing, the two (2) used doors were left mostly closed to ensure complete ammonia capture. It was noted that even with the two (2) doors open there is a significant airflow into the building through the doorways.

During Week 2 of testing, the stack fan was turned off. Observation of the stack fan showed that the fan blades turned slowly indicating the stack was drafting. Air velocity, temperature and relative humidity measurements were taken at the stack and at the two (2) open doorways. Table 3-2 summarizes these measurements:

Table 3-2 Stack and Door Airflow Data With Stack Fan Off

<i>Date Time Location</i>	<i>Air Velocity (ft/min)</i>	<i>Calculated Airflow (cfm)</i>	<i>Temperature (°F)</i>	<i>Relative Humidity (%)</i>
10/13/03 10:40 AM Stack	1 ft in 530 2 ft in 430 3 ft in 383 average = 448	68,913	68.0	36.0
10/13/03 1:45 PM Stack	1 ft in 390 2 ft in 450 3 ft in 500 average = 447	68,759	74.0	27.0
10/14/03 9:10 AM Stack	1 ft in 350 2 ft in 450 3 ft in 330 average = 278	42,743	56.0	65.0
10/14/03 10:05 AM Stack	1 ft in 500 2 ft in 430 3 ft in 495 average = 475	73,121	65.0	59.0
10/13/03 9:25 AM East Door	30 out of Bldg 25 out of Bldg 55 out of Bldg		71.0	36.9
10/13/03 9:25 AM South Door	30 to 160 into Bldg		62.8	47.6
10/13/03 11:00 AM South Door	Airflow both in and out of building			
10/13/03 1:20 AM East Door	95 to 340 into Bldg		69.0	33.0
10/14/03 8:40 AM East Door	95 to 150 into Bldg		49.0	60.0
10/14/03 8:30 AM East Door	Varies 165 into Bldg 187 out of Bldg		52.0	64.0

As can be seen from the above table, with the stack fan off the airflow direction through the doors varied with the wind conditions, but overall drafting occurred up the stack, but at varying rates.

3.2 AMMONIA

As noted in Section 3.1 above, when the stack fan is operating all emission are captured and transmitted through the stack. Thus, ammonia samples were taken only during Week 1 of sampling. Table 3-3 summarizes the results of the ammonia sampling:

Table 3-3 Ammonia Sampling Results

<i>Sample ID Date Sample Time</i>	<i>Ammonia Collected in Sample (micrograms)</i>	<i>Sampling Rate (liters/min)</i>	<i>Average Air Velocity During Sampling (m³/min)</i>	<i>Ammonia Loading (pounds/hour)</i>
001 10/6/03 10:45 to 1:10	627	2.0 for 65 minutes 4.5 for 80 minutes 3.4 weighted average	14,470	2.4
002 10/6/03 11:10 to 2:53	1680	1.5	14,448	9.6
003 10/6/03 1:13 to 2:53	621	3.0	14,568	4.2
10/6/03 Average Ammonia Loading				5.4
004 10/7/03 8:35 to 1:00	414	2.0	14,107	1.5
005 10/7/03 8:35 to 1:00	1010	2.0	14,107	3.6
10/07/03 Average Ammonia Loading				2.5

Note: The laboratory reports of the results are included in Appendix C.

The average ammonia loading for each day is calculated because there are variations in the results for samples taken at the same time periods on the same day. For example, both samples taken on October 7, 2003 were taken for the same length of time under identical sampling conditions and there is variation between the results.

3.3 ODOR

During Week 1 of sampling, odor samples were taken from the stack; while during Week 2, samples were taken from both open doorways and from the stack. In addition, on all occasions samples were taken with and without the Evane Scent spray system operating. The Evane Scent system consists of a fine mist spray system located at the stack and at the doorways used in processing. The system sprays an odor counteractant. All stack odor samples were collected at a rate of 4 to 5 liters per minute. All doorway samples were collected at a rate of 2 liters per minute. Table 3-4 summarizes the odor sample results:

Table 3-4 Odor Sampling Results

<i>Date</i> <i>Sample Location</i> <i>Sample ID</i>	<i>Sample</i> <i>Time</i>	<i>Odor</i> <i>Concentration</i> <i>(D/T)</i>	<i>Average Odor</i> <i>Concentration</i> <i>(D/T)</i>	<i>Evane Scent</i> <i>(On/Off)</i>
10/6/03 Stack 01 02 03 04 05 06 07	12:00 12:30 1:30 2:20 2:37 3:10 3:35	115 97 298 162 97 106 106	140	Off Off Off Off Off On On
10/7/03 Stack 08 09 010 011 012 013 014 015	8:55 9:20 9:45 10:15 10:45 11:35 12:35 12:47	354 250 211 250 211 126 298 115	227	Off Off Off Off Off On On On
10/13/03 Stack 02 Stack 05 Stack	10:40 1:45	177 325	251	On Off
10/13/03 East Door 01E 02E 03E 04E 05E	9:25 10:00 11:40 12:40 1:20	82 49 137 162 230	132	On On On Off Off
10/13/03 South Door 01S 02S 03S 04S 05S	9:25 10:00 11:00 12:40 1:20	63 53 106 210 273	141	On On On Off Off

10/14/03 Stack				
06 Stack	9:10	3,562		On
07 Stack	10:05	2,132	2,847	Off
10/14/03 East Door				
06E	8:40	89		On
07E	9:35	539		Off
08E	10:45	1,107		Off
09E	11:40	1,107		On
10E	12:40	354	639	On
10/14/03 South Door				
06S	8:30	35		On
07S	9:30	902		Off
08S	10:45	462		Off
09S	11:40	250		On
10S	12:40	273	384	On

Note: The laboratory results reports are included in Appendix C

3.4 MATERIALS PROCESSED

It was the intent to take samples on October 6th and 13th while processing roughly 75% digested and 25% undigested biosolids; and on October 7th and 14th to process roughly 25% digested and 75% undigested biosolids. Table 3-5 outlines the materials processed on the days the air samples were collected:

Table 3-5 Biosolids Processed During Sampling Days

October 6, 2003		October 7, 2003		October 13, 2003		October 14, 2003	
Material Type	Weight (tons)	Material Type	Weight (tons)	Material Type	Weight (tons)	Material Type	Weight (tons)
Digested	21.79	Digested	20.10	Digested	34.06	Undigested	34.50
Digested	34.17	Undigested	37.17	Digested	34.17	Undigested	35.28
Undigested	36.09	Undigested	38.08	Digested	34.12	Undigested	42.89
Digested	34.09	Digested	20.20	Digested	34.10	Undigested	37.18
Digested	25.00	Undigested	36.00	Undigested	35.69	Undigested	41.54
Undigested	35.45	Undigested	35.88	Undigested	36.95	Digested	32.30
Digested	33.97	Digested	32.64			Digested	21.82
Digested	34.11	Undigested	35.69				
Total	254.67	Total	255.76	Total	209.09	Total	245.51
% Digested	72%	% Digested	29%	% Digested	65%	% Digested	22%
% Undigested	28%	% Undigested	71%	% Undigested	35%	% Undigested	78%

The data for October 6 and 7 are arranged in the order the materials were processed. On October 13 and 14, the order of processing of the loads of digested and undigested material was mixed. However, the exact order is not available. Table 3-6 summarizes the sampling times as compared to the processing schedule:

Table 3-6 Biosolids Processing Time Schedule

<i>Date</i>	<i>Processing Schedule</i>	<i>Sampling Schedule</i>
October 6, 2003	Start: 10:00 AM Finish: 6:25 PM	Start: 10:45 AM Finish: 3:50 PM
October 7, 2003	Start: 8:25 AM Finish: 12:55 PM More material arrived later with further processing	Start: 8:35 AM Finish: 1:00 PM
October 13, 2003	Start: 8:45 AM Finish: 3:30 PM	Start: 9:25 Finish: 1:45 PM
October 14, 2003	Start: 8:10 AM Finish: Late afternoon after sampling ended	Start: 8:40 AM Finish 12:40 PM

Most of the sampling occurred during the processing of the first three (3) to four (4) loads of material. The loads were tipped in the processing area to concentrate the processing of either digested or undigested material as planned for the sampling. The tipping of material to favor one or the other type was discussed and verified with the operators each day before the start of sampling.

Based on the tipping schedule, it can be seen that on October 6th about 60% of the material processed during sampling was digested. On October 7th, about 20% of the material processed was digested. As noted above, the exact schedule of tipping is unavailable for October 13th and 14th; however, a tipping routine similar to October 6th and 7th was followed. Thus, the general goal of testing while processing either mostly digested or undigested biosolids was met.

4.0 CONCLUSION

The NY DEC Air Permit (ID 5-0942-00006/00009) sets the following conditions on the N-Viro operations at the facility that were examined in this testing:

- Condition 22, Item 22.2, Maximum stack odor emission 100 D/T
- Condition 25, Item 25.2, Maximum average Ammonia emission 9.0 pounds/hour
- Condition 20, Item 20.2, Maximum of 25% of materials processed through the facility may be digested.

In addition, the Operator wished to test the effect of turning off the stack fan on emissions at the doorways.

The stack emission on October 6th and 7th varied from 97 to 354 D/T with daily averages of 140 D/T on the 6th and 227 on the 7th. The majority of the readings exceed the 100 D/T limit set by Condition 22 of the Air Permit. Examining the daily average readings, it can be seen that processing mostly digested biosolids reduced odor emissions. This pattern is also evident in the odor emissions at both the doors and stack on the 13th and 14th.

The use of the Evane Scent mist spray appears to emitted odors but not enough to meet the Condition 22 limits. With only one (1) exception, the odor measured with the Evane Scent operating was less than odors tested at the same location with the misting system off.

With the stack fan turned off, the emissions at the doors generally exceed the 100 D/T stack limit. The door odors ranged from 35 to 1,107.

The average ammonia emissions were 5.4 pounds per hour on October 6th and 2.5 pounds per hour on October 7th. Processing high amounts of digested biosolids increased the ammonia emission by more than 100%, but was still less than the 9.0-pound per hour average limit set by Condition 25. All but one (1) sample were well below the permit allowable, with one (1) sample exceeding the allowable. Based on the data the facility complies with Condition 25.

Condition 20 limits the amount of digested biosolids processed through the facility to 25% of the material processed. The sampling data suggests this restriction is not needed. Although odor emissions exceeded the allowable, they were lower when the higher proportion of material processed was digested (see table 4-1). This would be expected since generally digested biosolids have lower odor emission than undigested material.

Table 4-1 Stack Odor Data for Mostly Digested vs Mostly Undigested Biosolids

<i>Date</i>	<i>Biosolids Processed</i>	<i>Average Odor Concentration (D/T)</i>	<i>Odor Concentration Range (D/T)</i>
10/6/03	Mostly Digested	140	97 to 298
10/7/03	Mostly Undigested	227	115 to 354
10/13/03	Mostly Digested	251	117 to 325
10/14/03	Mostly Undigested	2,847	2,132 to 3,562

Digested biosolids generally have higher ammonia emissions than undigested material. This is evident from the sampling as well. However, the facility average ammonia emission while processing mostly digested biosolids was only 60 % of the allowable.

APPENDIX A

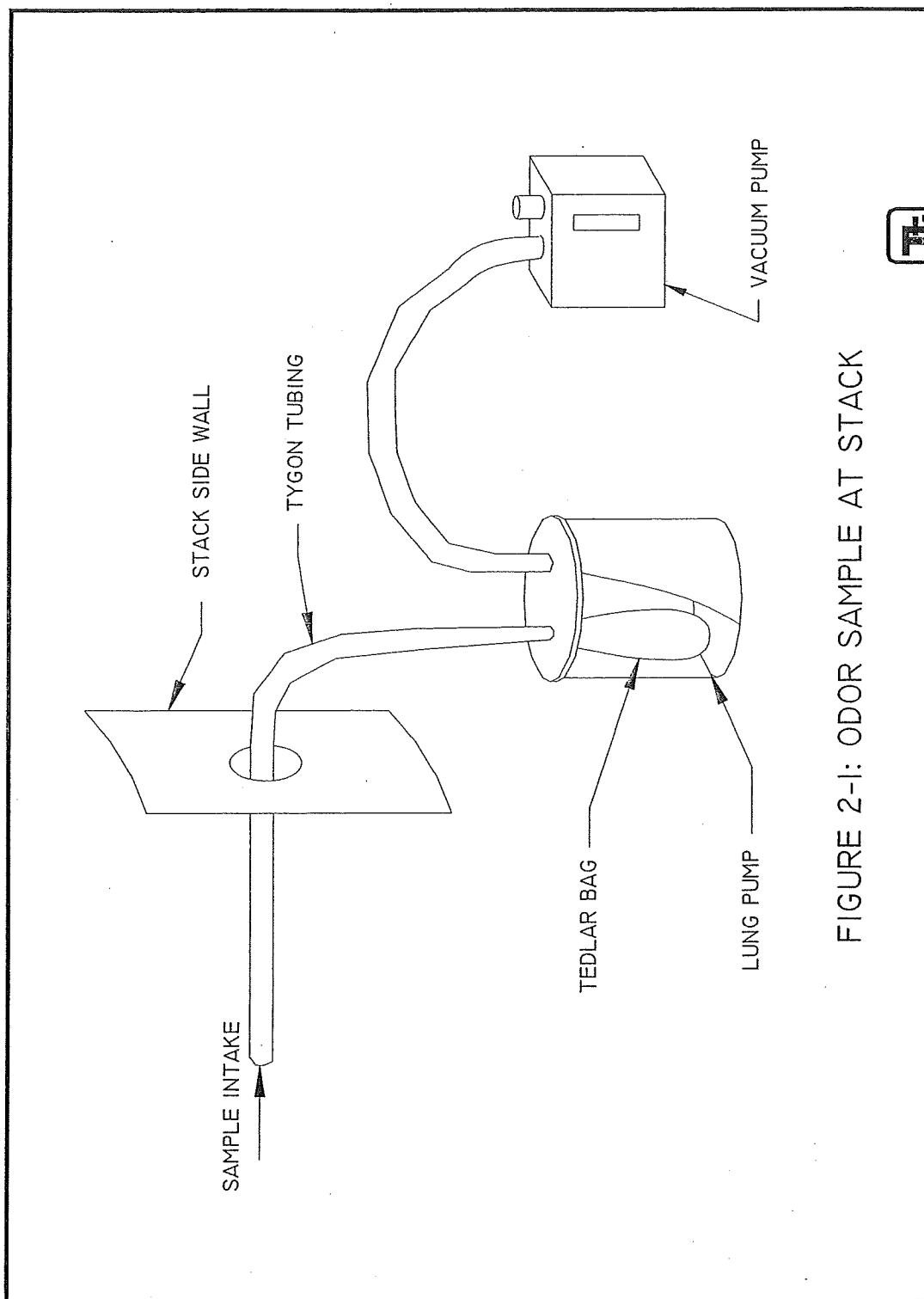


FIGURE 2-1: ODOR SAMPLE AT STACK



TETRA TECH

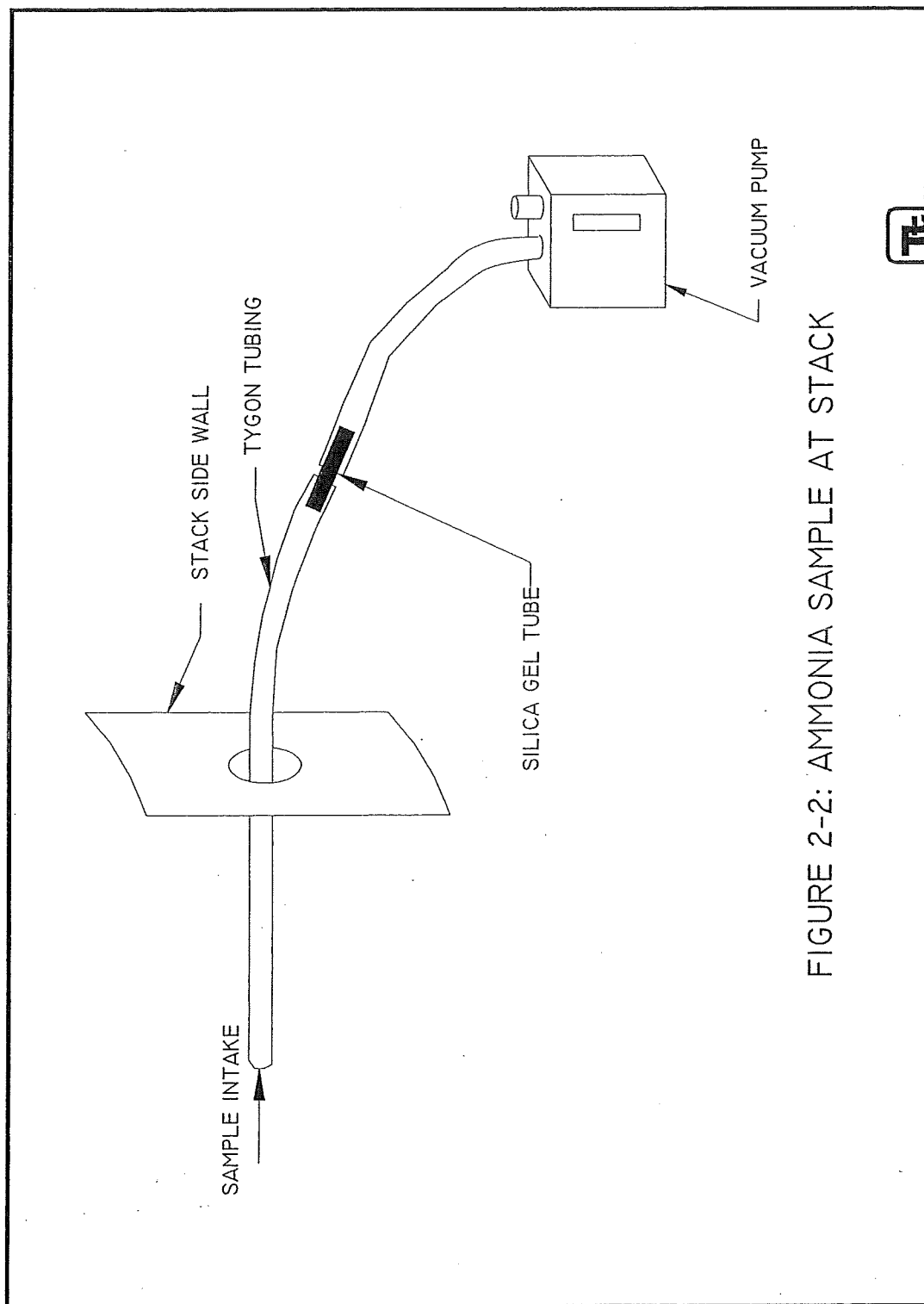


FIGURE 2-2: AMMONIA SAMPLE AT STACK



TETRA TECH

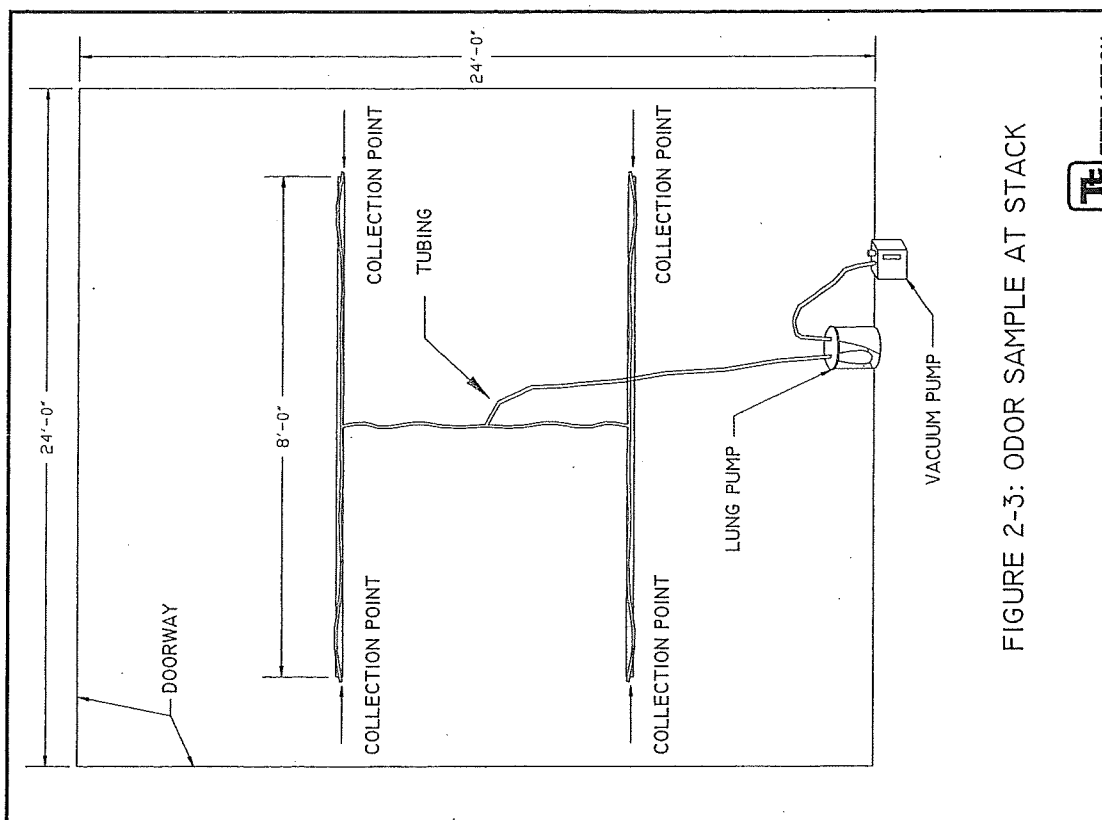


FIGURE 2-3: ODOR SAMPLE AT STACK

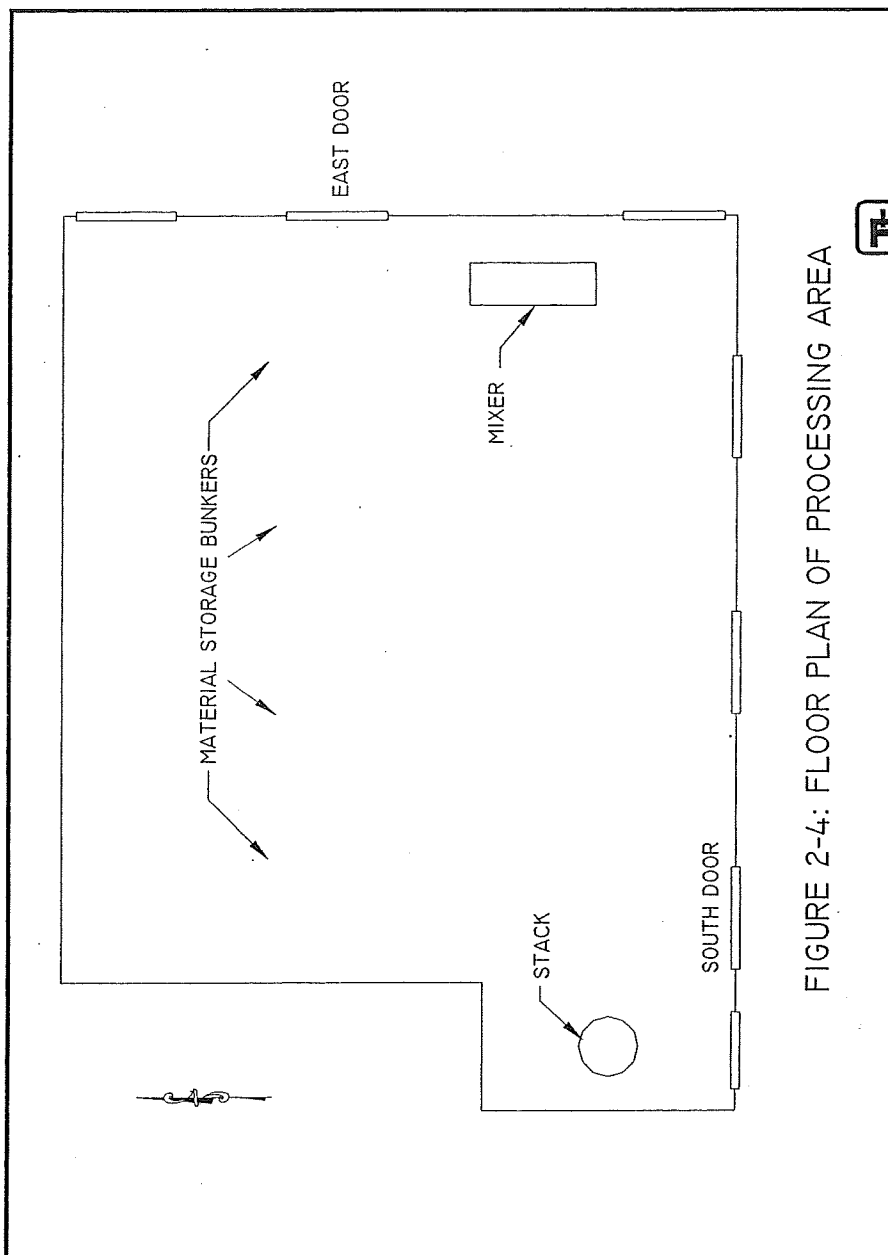


FIGURE 2-4: FLOOR PLAN OF PROCESSING AREA

APPENDIX B

July 25, 2003

Mr. Michael Sundberg
NYS Department of Environmental Conservation
Region 5
PO Box 220
Warrensburg, NY 12885

Reference: Clinton County Biosolids Processing Facility
Facility DEC ID: 5094200006
Permit ID: 5-0942-00006/00009

Dear Mr. Sundberg:

The following sampling protocol has been revised to incorporate question and comments we have discussed by e-mail and telephone:

The above referenced facility has begun N-Viro operations. To date, only the N-Viro process has been started up and is operational. The following ammonia and odor sampling protocol is submitted for NYDEC review and approval prior to testing in accordance with the above referenced permit. The applicable sections of the permit for the N-Viro processing are Conditions 20, 22, and 25. The specific sampling addressed in this protocol is covered under Conditions 22 and 25 (odor and ammonia for N-Viro operations only).

Condition 20 limits the daily quantity of anaerobically digested sludge to 25% of the volume of biosolids processed. It further states that this limit may be modified based on stack testing. The facility operators wish to test operating conditions with a higher digested biosolids portion of the sludge processed. The operator also wishes to test an operating condition in which the stack is not used for emissions releases, but rather all releases are through the opened doors of the facility.

To meet the requirements of Conditions 22 and 25, and to test operations at higher digested biosolids loading and with door emission release, the following protocol is proposed for your approval:

The proposed sampling will cover four (4) different operating conditions with a full day of sampling required for each condition. The following four (4) conditions will be examined:

- Test 1-Processing +/- 75% digested biosolids with emission through the stack
- Test 2-Processing +/- 25% digested biosolids with emission through the stack
- Test 3-Processing +/- 75 % digested biosolids with emission through the doorways

- Test 4-Processing +/- 25 % digested biosolids with emission through the doorways

Four (4) days on site will be needed to complete the sampling. The following is an outline of the proposed sampling:

Test 1

75% digested sludge (Week 1, Day 1 Test)

Emission at stack

- Ammonia testing
 - Sample for one (1) hour minimum each for four (4) times
 - Keep all doors nearly closed to ensure negative draw
 - Measure flow once per hour during sampling
- Odor testing
 - Collect two (2) odor samples each hour for a minimum of four (4) hours

Test 2

25% digested sludge (Week 1, Day 2 Test)

Emission at stack

- Ammonia testing
 - Sample for about one (1) hour minimum of four (4) times
 - Keep all doors closed or nearly closed to ensure negative draw
 - Measure flow once per hour during sampling
- Odor testing
 - Collect two (2) odor sample each hour for minimum of four (4) hours

Test 3

75% digested sludge (Week 2, Day 1 Test)

Emission at Doors

- Ammonia testing
 - Use results from stack testing since the amount of ammonia released will not change on average whether released out the stack or through the doors.
- Odor testing
 - Have four (4) collection points at each door
 - Collect two (2) 10-minute duration samples at each door (all doors simultaneously) each hour for four (4) hours [16 total samples for four (4) doors]

Test 4

25% digested sludge (Week 2, Day 2 Test)

Emission at Doors

- Ammonia testing
 - Use results from stack testing since the amount of ammonia released will not change on average whether released out the stack or through the doors.
- Odor testing
 - Have four (4) collection points at each door

- Collect two 10 minute duration samples at each door (all doors simultaneously) each hour for four (4) hours [16 total samples for four (4) doors]

The ammonia emission allowance is based on pounds of ammonia emitted per hour. The number of pounds of ammonia leaving the facility will be the same whether it leaves by way of the stack or through the doors. Therefore, it is proposed to only sample at the stack where the most accurate emission estimate can be obtained.

The stack is 110 feet tall. However, the fan driving air up the stack is located much closer to the ground. There are no emission inputs to the stack above the driving fan. It is proposed that stack samples be taken two (2) stack diameters above the driving fan. This location will capture all emissions.

Samples will be taken during processing operations so as to get an accurate reflection of the overall ammonia and odor emissions from the facility. For sampling at the doorways, an assembly will be constructed that will hold four (4) sampling ports all equally spaced across the door opening. This will divide the door into four (4) quadrants with a sampling port in the center of each quadrant. All ports will draw equally to the sample collection bag. Samples will be collected from all doorways simultaneously to account for changing wind patterns and to ensure no emissions escape undetected. With the stack fan off and the doors open, the velocity in the stack will be checked. If there is air movement in the stack, an additional odor sample will be taken from the stack when sampling at the doors.

Ammonia samples will be collected in sorbent tubes and analyzed in accordance with NIOSH Method 6016. This method combines the sampling with analysis Method 6701 and OSHA ID-188. A laboratory could not be located that analyzed by Method 6701 alone. An online search of the NIOSH web site produces Method 6016 when searching for Method 6701. An extension arm will be used to collect the samples. This will allow continual traversing of the stack.

There are two changes to the sampling protocol employed to obtain an accurate reading of the ammonia; Drager tubes will be used to approximate the concentration of ammonia. The sampling time is then adjusted to ensure that the sample taken falls within the loading range of the method. It may also be necessary to adjust the sampling rate. Low sampling rates are often called for in room air sampling where the air movement rate is very low. In this case, the sampling will be from a high volume stack moving approximately 400,000 cfm. At this high rate, the sampling rate can be increased without reducing the accuracy of the sample.

The airflow through the stack will be measured using a hot wire anemometer and stack diameter measurement. The airflow will be checked with facility doors open and closed. The temperature of the air will be recorded and relative humidity will be found from local weather data.

Odor samples will be collected in Tedlar bags using a lung pump. The samples will be analyzed using the forced choice olfactometer method in accordance with ASTM E 679 as prescribed in Item 22.2 of the permit.

It should be noted that the intent of the sampling is to collect representative measurements of ammonia and odor in accordance with the DEC permit and the above protocol. Minor adjustments to sampling times and conditions (such as the number of doors open and position of the doors) may be made in the field to get the most representative samples of emissions. All conditions and methods will be documented in the sampling report.

The dates for the sampling have not yet been established. These dates are subject to the following:

- Acceptance of the sampling protocol by the New York DEC
- The ability of the facility to ensure ample material available on site for processing during testing

The DEC will be notified a minimum of one (1) week before testing. The site will be available for inspection during testing by the DEC.

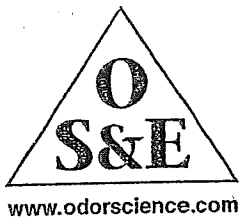
Please review the above protocol and comment at your earliest convenience. If you have any questions please do not hesitate to contact me by phone at 781-344-6446 or by e-mail at charlie.alix@ttisg.com

Sincerely,

Charles Alix, P.E.
Senior Engineer

C Paul LaFond – US Filter

APPENDIX C



Odor Science & Engineering, Inc.
1350 Blue Hills Avenue, Bloomfield, CT 06002
(860) 243-9380 Fax: (860) 243-9431

October 16, 2003

Charles Alix, P.E.
Tetra Tech, Inc
1629 Central Street
Stoughton, MA 02072

FAX: (781) 344-0907

RE: Odor Panel Analysis -- October 7th, 8th, 14th & 15th, 2003
Tetra Tech Project: 2809-0002-00 1001
OS&E Project No. 1383-W-00

Dear Charlie:

This letter presents the results of the recent odor panel analyses conducted by Odor Science & Engineering, Inc. (OS&E) for Tetra Tech. The first sampling event took place on October 6th and 7th, 2003. A total of fifteen (15) odor emission samples were collected by field personnel over these 2 days. The second sampling event took place on October 13th and 14th, 2003. A total of twenty-four (24) samples were collected over these 2 days. All samples were collected into preconditioned 12-liter Tedlar gas sampling bags supplied by OS&E. Each day following sample collection, the bags were shipped via overnight delivery service to OS&E's Olfactory Laboratory in Bloomfield, CT. All samples arrived intact under chain of custody requesting sensory analysis.

Upon arrival each day the samples were analyzed by dynamic dilution olfactometry using a trained and screened odor panel of 8 members. The odor panelists were chosen from OS&E's pool of panelists from the Greater Hartford area who actively participate in ongoing olfactory research and represent an average to above average sensitivity when compared to a large population. The samples were quantified in terms of dilution-to-threshold (D/T) ratio and odor intensity in accordance with ASTM Methods E-679-91 and E-544-99, respectively. The odor panelists were also asked to describe the odor character of the samples at varying dilution levels. The odor panel methodology is further described in Attachment A.

The results of the odor panel tests are presented in the attached Tables 1 and 2 for the October 6th/7th and 13th/14th sampling events, respectively.

We appreciate the opportunity to be of service to Tetra Tech on this project. Please feel free to call me if you have any questions concerning these results.

Sincerely,
ODOR SCIENCE & ENGINEERING, INC.

Martha O'Brien
Principal

Offices in Florida and California

Table 1. Results of dynamic dilution olfactometry analysis – October 7 and 8, 2003

Tetra Tech, Inc.: 2809-0002-00 1001

OS&E Project No. 1383-W-00

Sample		Odor Conc. D/T ⁽¹⁾	Stevens' Law Constants ⁽²⁾		Odor Character ⁽³⁾
			a	B	
10/06/03	01	115	0.63	0.92	rotten, garbage, rotten fish, rotten potatoes, urine, bad shrimp, NH ₃
10/06/03	02	97	0.59	0.71	rotten garbage, fish, urine, bad shrimp/seafood, bad potatoes
10/06/03	03	298	0.72	0.71	rotten fish, garbage, feces, rotten compost, bad shrimp, sewage, urine, NH ₃
10/06/03	04	162	0.62	0.95	rotten garbage, rotten fish, bad shrimp, urine, sewage, rotten compost
10/06/03	05	97	0.56	0.88	rotten fish, garbage, urine, rotten compost, bad shrimp
10/06/03	06	106	0.67	1.10	rotten fish, rotten garbage, rotten potatoes, bad shrimp, urine, ammonia
10/06/03	07	106	0.63	0.96	rotten garbage, fish, urine, ammonia, rotten potatoes, bad shrimp
10/07/03	08	354	0.57	0.87	sewage, rotten compost sludge, garbage, fecal, rotten cauliflower, barnyard, rotten mercaptan
10/07/03	09	250	0.60	0.81	garbage, rotten cauliflower, rancid, fecal, sewage, urine, rotten fish, compost
10/07/03	010	211	0.62	0.79	sewage, sludge, sulfur, rotten eggs, garbage, vomit, moldy, rotten cabbage, rotten cauliflower, fecal
10/07/03	011	250	0.72	0.64	rotten garbage, sewage, rotten cauliflower, rotten meat, fecal, rancid cheese, fish, rotten composted garbage
10/07/03	012	211	0.52	0.81	sewage, rotten fish, garbage, rotten cauliflower, fecal, compost
10/07/03	013	126	0.68	0.64	garbage, rotten fish, dirty feet, rotten cauliflower, fecal
10/07/03	014	298	0.59	0.82	rotten sewage, sludge, rotten fish, rotten composted garbage, rotten cauliflower, rotten vegetables
10/07/03	015	115	0.59	0.74	garbage, sewage, fecal, rotten meat, rotten fish, rotten cauliflower

1. D/T = dilutions-to-threshold

2. Stevens' Law correlates odor concentration (C) and odor intensity (I): $I = aC^b$. The constants a and b were determined by regression analysis based on the intensity ratings of the odor panel at varying dilution levels. I = 0-8 (based on the n-butanol intensity scale), C = odor concentration (D/T) typical of ambient odor levels.

3. Summary of odor character descriptors used by the panelists at varying dilution levels.

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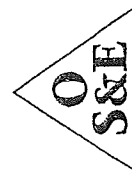


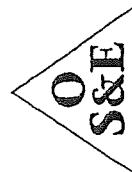
Table 2. Results of dynamic dilution olfactometry analysis – October 14 and 15, 2003
Tetra Tech, Inc.: 2809-0002-00 1001
OS&E Project No. 1383-W-00

Sample		Odor Conc. D/T ⁽¹⁾	Stevens' Law Constants ⁽²⁾		Odor Character ⁽³⁾
			a	b	
10/13/03	01E	82	0.37	1.10	rotten fish, urine, rotten meat, garbage, rotten vegetables, sludgy, moldy
10/13/03	01S	63	0.49	1.08	rotten fish, urine, rotten meat, rotten vegetables
10/13/03	02E	49	0.51	0.94	rotten fish, urine, rotten eggs, rotten meat, rotten grass, sludgy
10/13/03	02S	53	0.50	0.87	rotten fish, rotten eggs, rotten vegetables, rotten meat, sludgy
10/13/03	02 stack	177	0.57	0.88	rotten fish, urine, sewer, rancid, rotten meat, garbage
10/13/03	03E	137	0.45	0.81	rotten fish, urine, fecal, moldy, mildew, garbage, ammonia, rotten meat
10/13/03	03S	106	0.46	0.88	rotten fish, sludgy, urine, rotten meat, rotten eggs, rotten vegetables
10/13/03	04E	162	0.42	0.81	rotten, garbage, sewage, rotten fish, rotten meat, ammonia
10/13/03	04S	210	0.78	0.51	rotten fish, litter box, rotten garbage, rotten meat, moldy
10/13/03	05E	230	0.33	0.85	rotten fish, litter box, rancid, fecal, rotten eggs, garbage
10/13/03	05S	273	0.61	0.67	ammonia, urine, rotten fish, rotten eggs, rotten meat, sewage, garbage
10/13/03	05 stack	325	0.48	0.97	rancid, sewage, rotten fish, rotten meat, fecal
10/14/03	06E	89	0.42	1.04	rotten fish, rotten, sludgy, outhouse, rotten meat, sewage, garbage
10/14/03	06S	35	0.51	0.78	rotten fish, sewage, garbage, earthy
10/14/03	06 stack	3,562	0.49	0.81	sewage, sludgy, fecal, garbage, rotten meat
10/14/03	07E	539	0.58	0.80	rotten, rotten fish, garbage, fecal, sludgy, rotten meat, sewage
10/14/03	07S	902	0.40	0.83	sewage, garbage, rotten grass, fishy, sludgy
10/14/03	07 stack	2,132	0.86	0.56	sewage, sludgy, rotten, garbage, rotten fish
10/14/03	08E	1,107	0.84	0.88	sewage, garbage, fecal, sludgy
10/14/03	08S	462	0.46	0.87	sludgy, sewage, rotten meat, landfill gas, fishy, garbage
10/14/03	09E	1,107	0.44	0.80	sewage, fishy, garbage, rotten, onion, sludgy
10/14/03	09S	250	0.64	0.75	sewage, garbage, rotten vegetables/cabbage, fecal
10/14/03	010E	354	0.41	1.01	sewage, fecal, rotten fish, garbage, sauerkraut
10/14/03	010S	273	0.57	0.87	garbage, sewage, rotten vegetables

1. D/T = dilutions-to-threshold

2. Stevens' Law correlates odor concentration (C) and odor intensity (I): $I = aC^b$. The constants a and b were determined by regression analysis based on the intensity ratings of the odor panel at varying dilution levels. I = 0-8 (based on the n-butanol intensity scale), C = odor concentration (D/T) typical of ambient odor levels.

3. Summary of odor character descriptors used by the panelists at varying dilution levels.



ATTACHMENT A
Odor Science & Engineering, Inc.
Odor Panel Methodology

Measurement of Odor Levels by Dynamic Dilution Olfactometry

Odor concentration is defined as the dilution of an odor sample with odor-free air, at which only a specified percent of an odor panel, typically 50%, will detect the odor. This point represents odor threshold and is expressed in terms of "dilutions-to-threshold" (D/T).

Odor concentration was determined by means of OS&E's forced choice dynamic dilution olfactometer. The members of the panel who have been screened for their olfactory sensitivity and their ability to match odor intensities, have participated in on-going olfactory research at OS&E for a number of years.

In olfactometry, known dilutions of the odor sample were prepared by mixing a stream of odor-free air with a stream of the odor sample. The odor-free air is generated in-situ by passing the air from a compressor pump through a bed of activated charcoal and a potassium permanganate medium for purification. A portion of the odor free air is diverted into two sniff ports for direct presentation to a panelist who compares them with the diluted odor sample.

Another portion of the odor-free air is mixed in a known ratio with the odor from the sample bag and is then introduced into the third sniff port. A panelist is thus presented with three identical sniff ports, two of which provide a stream of odor-free air and the third one a known dilution of the odor sample. Unaware of which is which, the panelist is asked to identify the sniff port which is different from the other two, i.e., which contains the odor. The flow rate at all three nose cups is maintained at 3 liters per minute.

The analysis starts at high odor dilutions. Odor concentration in each subsequent evaluation is increased by a factor of 2. Initially a panelist is unlikely to correctly identify the sniff port which contains an odor. As the concentration increases, the likelihood of error is reduced and at one point the response at every subsequently higher concentration becomes consistently correct. The lowest odor concentration at which this consistency is first noticed, represents the **detection odor threshold** for that panelist.

As the odor concentration is increased further in the subsequent steps, the panelist becomes aware of the odor character, i.e. becomes able to differentiate the analyzed odor from other odors. The lowest odor concentration at which odor differentiation first becomes possible, represent the **recognition odor threshold** for the panelist. Essentially all of OS&E's work is done with recognition odor threshold. By definition the threshold odor is equal to 1 D/T (i.e. the volume of odorous air after dilution divided by the volume before dilution equals one).

The panelists typically arrive at threshold values at different concentrations. To interpret the data statistically, the geometric mean of the individual panelist's thresholds is calculated.

The olfactometer and the odor presentation procedure meet the recommendations of ASTM Standard Practice for Determination of Odor and Taste Thresholds by a Forced-Choice Ascending Concentration Series of Limits (ASTM E679-91). The analysis will be carried out in the OS&E Olfactory Laboratory in Bloomfield, Connecticut.

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Odor Intensity

Odor intensity is determined using reference sample method with n-butanol as the reference compound (ASTM Method E-544-99). The n-butanol odor intensity scale is based on n-butanol vapor as odorant at eight concentrations. The concentration increases by a factor of two at each intensity step, starting with approximately 15 ppm at step 1.

Odors of widely different types can be compared on that scale just like the intensities of the lights of different colors can be compared to the intensity of standard, e.g. white light. Odor character and hedonic tone are ignored in that comparison. Odor intensities are routinely measured as part of the dynamic dilution olfactometry measurements. The n-butanol vapor samples are presented to the panelists in closed jars containing the standard solutions of n-butanol in distilled water. The vapor pressure above the butanol solutions corresponds to the steps on the n-butanol scale. To observe the odor intensity, a panelist opens the jar and sniffs the air above the liquid. The panelist then closes the jar so that the equilibrium vapor pressure of butanol can be re-established before the next panelist uses the jar. The odor in the jar is compared with unknown odor present at the olfactometer sniff port.

The relationship between odor concentration and intensity can be expressed as a psychophysical power function also known as Steven's law (Dose-Response Function). The function is of the form:

$$I = aC^b$$

where:

I = odor intensity on the butanol scale

C = the odor level in dilution-to-threshold ratio (D/T)

a,b = constants specific for each odor

The major significance of the dose-response function in odor control work is that it determines the rate at which odor intensity decreases as the odor concentration is reduced (either by atmospheric dispersion or by an odor control device).

Odor emissions are used as input to an odor dispersion model, which predicts odor impacts downwind under a variety of meteorological conditions. Whether or not an odor is judged objectionable depends primarily in its intensity. The dose-response constants are used to convert predicted ambient odor concentration to intensity levels. OS&E experience has shown that odors are almost universally considered objectionable when their intensity is 3 or higher on the 8-point n-butanol scale. In general, the lower the intensity, the lower the probability of complaints.

Odor Character Description

Odor character refers to our ability to recognize the similarity of odors. It allows us to distinguish odors of different substances on the basis of experience. We use three types of descriptors, general such as "sweet", "pungent", "acrid", etc. or specific references to its source such as "orange", "skunk", "paint", "sewage", etc., or to a specific chemical, e.g. "methyl mercaptan", "butyric acid", or "cyclohexane". In the course of the dynamic dilution olfactometry measurements, the odor panelists are asked to describe the character of the odors they detect.

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Group No. H281-042
Account No. 20309170
Report Date: 10/20/03

CHARLES ALIX
TETRA TECH INC
SUITE 3
1629 CENTRAL STREET
STOUGHTON, MA 02072-1693

**** FINAL REPORT ****

Date Received: 10/08/03
Sample Type: 5 - Air Sample(s)
Project:

PO Number: 2809-0002-00 1001

Analytical Results

Lab	Parameter	Volume	Amount	LOQ	Concentration	Analysis
-001 1	Silica Gel Tube Trtd with Sulfuric Acid					10/20/03
-	NH3 Front		627 ug	2.5 ug		10/17/03
-	NH3 Rear		ND	2.5 ug		10/20/03
-	NH3 Total	NVG L	627 ug	2.5 ug	-- --	
-002 2	Silica Gel Tube Trtd with Sulfuric Acid					10/20/03
-	NH3 Front		104 ug	2.5 ug		10/20/03
-	NH3 Rear		1580 ug	2.5 ug		10/20/03
-	NH3 Total	NVG L	1680 ug	2.5 ug	-- --	
Tube appears to have been sampled backward.						
-003 3	Silica Gel Tube Trtd with Sulfuric Acid					10/17/03
-	NH3 Front		< 2.50 ug	2.5 ug		10/20/03
-	NH3 Rear		621 ug	2.5 ug		10/20/03
-	NH3 Total	NVG L	621 ug	2.5 ug	-- --	
Tube appears to have been sampled backward.						
-004 4	Silica Gel Tube Trtd with Sulfuric Acid					10/20/03
-	NH3 Front		414 ug	2.5 ug		10/17/03
-	NH3 Rear		ND	2.5 ug		10/20/03
-	NH3 Total	NVG L	414 ug	2.5 ug	-- --	
-005 5	Silica Gel Tube Trtd with Sulfuric Acid					10/20/03
-	NH3 Front		1010 ug	2.5 ug		10/17/03
-	NH3 Rear		ND	2.5 ug		10/20/03
-	NH3 Total	NVG L	1010 ug	2.5 ug	-- --	



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Group No. H281-042
Account No. 20309170
Report Date: 10/20/03

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STOUGHTON, MA 02072-1693

Final Report

Date Received: 10/08/03
Sample Type: 5 - Air Sample(s)
Project:

PO Number: 2809-0002-00 1001

Analytical Results

Lab	Parameter	Volume	Amount	LOQ	Concentration	Analysis
-----	-----------	--------	--------	-----	---------------	----------

Abbreviations: ug = micrograms, mg = milligrams, mg/M3 = milligrams per cubic meter of air, g = grams, ug/M3 = micrograms per cubic meter of air, L = liters, w/w = percent weight basis, all Volumes given in liters, ppm = parts per million, ppb = parts per billion, Areas given in square feet; ND = Not Detected; ug/wp = ug/wipe; NVG = No Volume Given.



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Group No. H281-042
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Report Date: 10/20/03

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Final Report

Summary of Analytical Methods

Compound Name	Analytical Method	Abbreviation
Ammonia Total	NIOSH 6016	NH3 Total

Notes

Attached are the results we obtained on the analysis of your samples. Any Chains-of-Custody associated with this sample group are also enclosed. Air concentrations are calculated as a convenience to the client and the overall accuracy of this result depends on both the accuracy of the air volume and the amount found by analysis. Theoretical Air Volumes for passive monitors are calculated using the sampling time submitted and the manufacturer's listed sampling rate for each compound.

For blanks and non-detects the results indicated with a '<' value represents the reporting limit for that analysis. Unless otherwise noted results are not corrected for blank values.

Unless the signature of the appropriate manager(s) appears on the final page of this report, this report should be considered PRELIMINARY and is subject to change.

We appreciate your confidence in allowing Analytics to be your testing laboratory. Any questions regarding this report can be addressed by calling our client services department (800-888-8061).


James A. Calpin, CIH
Laboratory Director

End of Report
Page 3

Appendix G
April 2004 Odor Model Report

Appendix H
Clinton County Biosolids
Processing Facility
Odor Response Plan

Clinton County Biosolids Facility

Odor Complaint Response Procedure

The goal of the facility is to be a good neighbor and not create nuisance odors in the surrounding community. However, it is reasonable to assume that upsets may occur. This response procedure will be part of the facility operation. The procedure has the following objectives:

- Provide a mechanism for the public to inform the facility of odors;
- Ensure quick investigation of and response to possible causes;
- Inform the public of actions taken; and
- Provide records for use by the NY DEC is assessing the nuisance prevention operations.

Mechanism for Complaint Reporting

Before the facility commences operations it will publish in the local legal notices the intent to begin operations and a phone number at the facility where the community can call in to report nuisance odors. The facility will maintain an answering machine or service at that number that will record complaint messages 24 hours per day seven days per week.

Rapid Investigation and Response

The plant superintendent or his designee will check the message machine or service first thing each working day and at least three other times during the working day. If a complaint has been recorded the plant superintendent or his designee will record the complaint information on a complaint form (see the attached form) and immediately perform a complete inspection of the facility. The inspection will consist of walking around the entire facility and through all operating portion of the facility. Items to be investigated include, but are limited to, the following:

- Is the any raw or finished material outside;
- Is there spilled material outside;
- Are doors to processing areas left open;
- Is the Stack fan operating;
- Are hopper doors left open;
- Are covers on trucks, trailers or containers holding biosolids;
- Is there residual biosolids in emptied trailers or containers?

The results of the inspection will be noted on the complaint form as well as any actions taken.

Informing the Public of Action

Immediately following the inspection plant personnel will call back to the person who filed the complaint to let them know the resolution. If the source of the nuisance odor is not determined during the investigation the call back may provide valuable information that may make it easier to diagnosis the cause of the odor.

Records for Tracking Performance

A complaint form must be filled out each time a call is received. The forms will remain on file at the facility and will be available to DEC personnel upon request. These records as well as other public information such as newspaper reports will allow the DEC to determine the need for further testing and or modeling.

Odor Complaint Form

Plattsburgh Biosolids Processing Facility

Date: _____ Name of investigator: _____

Location: _____

Date and Time of Complaint; _____

Person Filing Complaint: _____

Address: _____

Phone number; _____

Nature of Complaint: _____

INVESTIGATION

Date and time of investigation: _____

Wind Direction, Speed and Temperature; _____

Description and Identification of Odor

Strength of Odor

1. _____ No Odor
2. _____ Faint
3. _____ Noticeable
4. _____ Definite
5. _____ Strong
6. _____ Overwhelmingly Strong

Description of Odor

1. _____ Musty
2. _____ Skunk
3. _____ Fecal
4. _____ Fishy
5. _____ Rotten Egg
6. _____ Other _____

Items Inspected and Results _____

Project Manager Notification and Action Taken _____

Return Call to Person Filing Complaint Date and Time; _____

Report Completed by: _____ Date: _____

Report Reviewed by: _____ Date: _____